REMARKS

Claims 1-14, 16-18, 20, 22, 24-31, 33-35, 37, 39, 40, 42, 43, and 46 are currently pending.

Since claims 15, 19, 21, 23, 36, 38, and 43 were not rejected by prior art, it is presumed that these claims have patentable subject matter. Claims 15, 19, 21, 23, 32, 36, 38, 41, 44, and 45 have been canceled. The subject matter of canceled claim 15 has been incorporated into claim 13. Claim 20 has been amended to include the subject matter of canceled claim 21. Claim 22 has been amended to include the subject matter of canceled claim 23. Claims 7, 30, and 42 have been amended for clarification purposes. Claim 35 has been amended to include the subject matter of canceled claim 36. Claim 37 has been amended to include the subject matter of canceled claim 38. Claim 40 has been amended to incorporate the subject matter of canceled claim 41. Claim 43 has been amended to overcome the 35 U.S.C. 112, second paragraph rejections. Claims 1, 25, and 39 have been amended to incorporate subject matter from paragraph 0017 of published patent application no. 2006/0111148 (which corresponds to applicant's application). New claim 46 is supported by the original claims. It is respectfully submitted that no new matter has been added.

The Patent Office rejected claims 15, 19, 21, 23, 36, 38, and 43 under 35 U.S.C. 112, second paragraph.

Claim 13 has been amended to incorporate the subject matter of claim 15 which was not rejected under prior art. Claim 13 has also been amended to describe P_2, as found in paragraph 0032 of published patent application no. 2006/0111148 (which corresponds to applicant's application).

Claims 20, 22, 35, 37, and 43 have been amended to describe i, n, and N, where claims 20, 22, 35, and 37 incorporate respectively subject matter from claims 21, 23, 36, and 38 not rejected under prior art and where claim 43 was not rejected under prior art. The mathematical expression recited in claim 43 is found in equation 3 of the published patent application no. 2006/0111148 (paragraph 0047). Vi has been amended to Vj consistent with the form of equation 3. N represents the number of beamforming vectors consistent with claim 22 and paragraph 0051, for example, and n represents the number of transmit antennas consistent with the abstract, paragraph 0045, and paragraph 0047.

The Patent Office rejected claims 20, 22, 35, 37, 40-42, and 44 under 35 U.S.C. 102(e) as being anticipated by Pautler, U.S. Published Patent Application No. 2003/0185309.

Because of the amendment of claims 20, 22, 35, and 37 to include subject matter from claims 21, 23, 36, and 28 which were not rejected under prior art, it is presumed that claims 20, 22, 35, and 37 are not anticipated by Pautler.

For a claim to be anticipated, each and every non-inherent claim limitation must be taught in a single reference. MPEP 2131.

Claim 40 recites as follows:

> A program of machine-readable instructions, tangibly embodied on an information bearing medium and executable by a digital data processor, to perform actions directed toward transmitting a beamformed signal, the actions comprising: quantizing at least two eigenvectors of a channel; receiving over a wireless channel an indication of power allocation among the at least two eigenvectors; and transmitting a signal along the at least two eigenvectors using a power allocation consistent with the received indication, wherein quantizing at least two eigenvectors comprises calculating a dominant one of the two eigenvectors in a codebook that maximizes $\left\| H(C_i^1)^\dagger \right\|_2$, said codebook also tangibly embodied on an information bearing medium.

The Patent Office asserted that "quantizing at least two eigenvectors comprises calculating a dominant one of the two eigenvectors in a codebook that maximizes $\left\| H(C_i^1)^\dagger \right\|_2$, said codebook also tangibly embodied on an information bearing medium" is taught in paragraph 0096 of Pautler.

Pautler, paragraph 0096, discloses as follows:

> The size of codebook subsets may not be integer powers of two (since their size is determined by the correlation threshold), which means that the successively computed weight sets are not efficiently quantized using an integer number of bits to separately represent each weight set. In this case, alternate embodiments may jointly code the weight sets using vector quantization, or use variable length code words to reduce the number of bits required to represent the entire V matrix. Note that these alternate embodiments still draw the antenna array weight sets from subsets of a single codebook of antenna array weight sets, with the difference being the source coding used to reduce the number of bits required to represent the V matrix.

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In paragraph 0096 of Pautler, there is no disclose of calculating a dominant eigenvector. Pautler does not teach "quantizing at least two eigenvectors comprises calculating a dominant one of the two eigenvectors in a codebook that maximizes $\left\| H(C_i^1)^\dagger \right\|_2$, said codebook also tangibly embodied on an information bearing medium." Thus, Pautler does not anticipate claim 40.

The Patent Office rejected claims 30-32 and 39 under 35 U.S.C. 102(e) as being anticipated by Kim, U.S. Published Patent Application No. 2002/0013130.

For a claim to be anticipated, each and every non-inherent claim limitation must be taught in a single reference. MPEP 2131.

Claim 30 recites as follows:

> A transceiver comprising: first circuitry for quantizing at least two eigenvectors for a signal to be transmitted; second circuitry for quantizing a power allocation among the at least two eigenvectors in a manner that is independent of the quantizing the at least two eigenvectors; and a transmitter for transmitting the signal along the at least two eigenvectors with the quantized power allocation among the at least two eigenvectors, wherein the power for the dominant eigenvector is P_1 and for a less dominant eigenvector is P_2, **the power allocation being $P_1=kP_2$; where k is selected from the group 1, 0.5, 0.2, and 0.**

The Patent Office asserted that the subject matter of claim 32 (incorporated into claim 30) is found in paragraph 0034 of Kim. Kim, in paragraph 0034, discloses "An algorithm for obtaining k satisfying 2 P max = max k P k" which is not a teaching of "the power allocation being $P_1 = kP_2$; where k is selected from the group 1, 0.5, 0.2, and 0." Thus, claim 30 is not anticipated by Kim.

Claim 39 recites as follows:
> A program of machine-readable instructions, tangibly embodied on an information bearing medium and executable by a digital data processor, to perform actions directed toward determining a parameter usable for beamforming, the actions comprising: for a channel matrix that is representative of a channel over which a signal was received, estimating a parameter in the channel matrix by selecting the value of a parameter in a codebook that minimizes a criterion, wherein the codebook is also tangibly embodied on an information bearing medium, **wherein when $2^{R/r}/t<1$, where R is a rate of transmission in bits/sec/Hz, r is a**

number of receive antennas, and t is a number of transmit antennas, a unit rank beamforming scheme is used, otherwise a higher rank beam forming scheme is used.

As Kim does not disclose "wherein when $2^{R/r}/t<1$, where R is a rate of transmission in bits/sec/Hz, r is a number of receive antennas, and t is a number of transmit antennas, a unit rank beamforming scheme is used, otherwise a higher rank beam forming scheme is used," Kim does not anticipate claim 39.

The Patent Office rejected claims 1-14, 16-18, 24-29, 33, and 34 under 35 U.S.C. 103(a) as being unpatentable over Pautler, U.S. Published Patent Application No. 2003/0185309, in view of Kim, U.S. Published Patent Application No. 2002/0013130.

Claims 16-18 are allowable because they depend from claim 13 which has been amended to incorporate the presumably allowable subject matter of claim 15.

Claim 1 recites as follows:

> A method of forming a beam of a signal to be transmitted, the method comprising: providing a codebook (C) of parameters that modify a transmitted signal: providing a channel matrix (H) of parameters representing the properties of a channel; transmitting a signal from a base station along the channel using an antenna comprising at least two elements; receiving said transmitted signal in a mobile station and estimating a parameter in the channel matrix characteristic of the channel by selecting the value of a parameter in the codebook that minimizes a criterion; transmitting an indication of the selected parameter over the return channel; and applying the codebook vector associated with the selected parameter to subsequent transmissions from the base station, **wherein when $2^{R/r}/t<1$, where R is a rate of transmission in bits/sec/Hz, r is a number of receive antennas, and t is a number of transmit antennas, a unit rank beamforming scheme is used, otherwise a higher rank beam forming scheme is used.**

Claim 25 recites as follows:

> A transceiver comprising: a receiver for receiving a first signal from a sender over a channel from at least two transmit antennas; a computer readable storage medium for storing a codebook C of parameter; circuitry coupled to the codebook and to the receiver for estimating a parameter of a channel matrix of the channel by selecting a value of a parameter in the codebook that minimizes a criterion; and a transmitter for transmitting to the sender an indication of the selected value of the parameter prior to

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receiving a second signal from the sender, **wherein when $2^{R/r}/t<1$, where R is a rate of transmission in bits/sec/Hz, r is a number of receive antennas, and t is a number of transmit antennas, a unit rank beamforming scheme is used, otherwise a higher rank beam forming scheme is used.**

Neither Pautler nor Kim teach or suggest the limitation of **wherein when $2^{R/r}/t<1$, where R is a rate of transmission in bits/sec/Hz, r is a number of receive antennas, and t is a number of transmit antennas, a unit rank beamforming scheme is used, otherwise a higher rank beam forming scheme is used.** Thus, claims 1-14, 25-29, and 46 are allowable over Pautler and Kim.

Claim 24 is allowable over Pautler and Kim because it depends from claim 20 which is allowable over Pautler and/or Kim.

Claims 33 and 34 are allowable over Pautler and Kim because they depend from claim 30 which is allowable over Pautler and/or Kim.

The Patent Office is respectfully requested to reconsider and remove the rejections of the claims under 35 U.S.C. 102(a) based on Pautler or Kim, or under 35 U.S.C. 103(a) based on Pautler and Kim, and to allow all of the pending claims 1-14, 16-18, 20, 22, 24-31, 33-35, 37, 39, 40, 42, 43, and 46 as now presented for examination. An early notification of the allowability of all of the pending claims is earnestly solicited.

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Respectfully submitted:

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